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ABSTRACT

Virtual worlds are becoming increasingly sophisticated, showing potentials as the platform for a variety of collaborative activities in business. This study examines user's intentions to use the virtual world, Second Life, and explores factors associated with the intentions. Based on the Technology Acceptance Model (TAM) and extended factors, a research model is proposed. The model is tested through a survey administered to business school students who have participated in Second Life. Preliminary results suggest that in the early stage of the virtual world participation, perceived ease of use has a stronger effect on user's behavioral intention to make use of the system than perceived usefulness. Perceived enjoyment of participating in the virtual world also significantly affects perceived ease of use. Limitations and future research are discussed.

Keywords

TAM, virtual world, Second Life

INTRODUCTION

The social networking capabilities of Web 2.0 have facilitated the use of the Internet and the Web much more as a collaborative platform than it was just a few years ago. In addition to information dissemination, advertising, and sales transactions, the Web is rapidly becoming popular as a place to conduct meetings, teach or take a class, interact virtually with others, or just socialize online.

Three-dimensional (3-D) social networking environments, or Internet-based virtual worlds, have been emerging rapidly since about 2003. A virtual world is a computer-based simulated environment created with two- and three-dimensional graphical representations of a physical space. People interact with one another via avatars, which are graphical, 2- or 3-D representations of a user. The virtual world environment is an immersive, virtual reality space. The most well known Internet-based virtual world today is Linden Labs' *Second Life* (www.secondlife.com), a 3-D virtual world where users can socialize using voice and text chat. Virtual worlds are attracting attention in industry as well as academia for their potential to enhance online business and societal communities.

Many companies, including IBM, are investing strategically in the three-dimensional (3-D) Internet technologies that enable virtual worlds (Lohr 2008, Ringo, 2007, Sarvary, 2008.) One study conducted by IBM Corporation examined the potential impact of 3-D gaming technologies on the IT industry (Paris, 2007). They concluded that companies should seriously consider the impact that games and virtual environments will have on business applications, products, and services. They further suggested that virtual world environments may have *transformative potential* to improve business processes, collaboration, and customer experiences. Currently, IBM promotes the 3-D Internet as "the essential tool for helping people work, live and play to their fullest potential" (IBM, 2008). In April 2008, it was reported that IBM and Linden Labs have begun working together to develop a Second Life project behind the corporate firewall (Lohr 2008.)

Gartner, Inc., a leading information technology research and advisory company presented its forecast for the future value of virtual worlds at its 2007 conference, stating that by the end of 2011, 80 percent of active Internet users and Fortune 500 enterprises will be participating in some form of virtual world (Gartner, 2007). They project that the community-related and collaborative aspects of virtual worlds will be of most value to corporate Internet users, while transaction-based, commercial activities will be of less importance. While they proposed that the collaborative and community aspects of virtual worlds will be significant, they also cautioned companies to invest cautiously, as the technology is young, and will continue to develop and mature.

There is a growing body of academic literature that explores the use of virtual worlds and avatars in business. V-commerce, or Virtual Commerce, describes the integrative use of the 3-D Internet and virtual worlds to market products and services. Barnes (2007) has recently developed a research agenda to examine the effectiveness of advertising towards intent to purchase. With more than 100 virtual worlds currently in existence online, new 3-D Internet environment models are emerging as opportunities to explore new integrative marketing channels. Barnes' research is among the first to empirically test the potential for avatars and virtual objects to influence trust and the intention to make purchases online in a 3-D virtual world.

Similar to how v-commerce models extend from e-commerce, v-learning can be viewed as an extension of e-learning (Baxter 2008, Cross, O'Driscoll, Trondsen 2007). Cross, et. al. propose ways in which the capabilities of virtual worlds may be used to enhance existing learning models. Besides the well known value of the Internet for electronic collaboration and anytime/anywhere learner and teacher participation, virtual worlds provide the new element of an *augmented reality*. With a self-created avatar, a participant can take on any role or persona in the virtual world and exist in that character, or any number of different characters. Furthermore, the virtual place itself can be a simulation of a real environment or one based strictly on the limits of the creator's imagination. This has the potential to create new simulation opportunities for learning in both corporate and academic settings. An upcoming issue of MIS Quarterly will focus specifically on virtual worlds. Baxter (2008) reported, in a recent interview with the guest editor for this special issue, Robin Tiegland, that it is expected that Second Life and other virtual worlds will be complementary to existing teaching methods for some time.

In this paper, we investigate the potential of Second Life as a V-Commerce environment. Second Life was chosen as the virtual platform because it is one of the most widely known virtual worlds. Second Life has grown from 2 million residents in January 2006 to more than 13 million residents as of April 2008, with over 1.2 Million users logging in during the last 60 days (Secondlife.com.) Anecdotal evidence suggests that there are many positive attributes associated with virtual worlds for collaboration and learning. In addition, the notion that the 18-34 year old group is the ideal target for this type of technology-enabled experience is commonly accepted. To date there is little, if any, empirical evidence to suggest that this population group perceives the expected value of virtual worlds the way industry analysts and researchers suggest. Using a survey based on the TAM model, our exploratory study empirically examines undergraduate business students' acceptance and intention to use virtual worlds for business value.

CONCEPTUAL BACKGROUND

This study applies the Technology Acceptance Model (TAM) (Davis, 1989) to a group of Second Life users. TAM has been recognized as one of the most powerful models in examining the acceptance of new information technology (IT). Adapted from the Theory of Reasoned Action (TRA) model, TAM posits that two beliefs – perceived ease of use (PEOU) and perceived usefulness (PU) - determine one's behavioral intention to use a technology (BI). Additionally, TAM indicates that PU is influenced by PEOU. Subsequent studies have applied TAM to a wide range of IT (Davis and Venkatesh, 1996; Gefen and Straub, 1997; Fang, Chan et al., 2006), including E-commerce (Gefen, 2003; Gefen and Straub, 2003). These studies show that TAM holds across IT types.

While the parsimony of TAM makes it easy to apply to a variety of situations, the leanness of the model is also considered as its key limitation. A number of studies have been conducted to examine additional antecedents of IT use, such as positive image (Moore and Benbasat, 1996), cultural dimensions (Straub, Keil et al., 1997; Mao and Palvia, 2006), and habit (Gefen, 2003), to provide a better understanding of other factors that contribute to the adoption or abandonment of new IT.

In this study, perceived enjoyment was examined as an antecedent to PEOU. Examining the antecedents to PEOU is important not only because PEOU may affect BI both directly and indirectly, but also because it relates to users' perceptions in the early stage of using a system. As Vendatesh (2000) puts it: "it is an initial hurdle that users have to overcome for acceptance, adoption, and usage of a system". Adapted from Davis, Bagozzi, and Warshaw (1992), perceived enjoyment (PE) is defined as the extent to which the activity of using a specific system is perceived to be enjoyable in it's own right, aside from any performance consequences resulting from system use. Previous studies show that PE is a significant antecedent to PEOU (Venkatesh, 2000).

RESEARCH MODEL AND HYPOTHESIS

Based on TAM and extended TAM theories, the research model examines four variables: PEOU (Perceived Ease of Use), PU (Perceived Usefulness), PE (Perceived Enjoyment), and BI (Behavioral Intention) to use Second Life (SL) for business purposes. The relationships among the variables and the hypotheses are depicted in Figure 1.

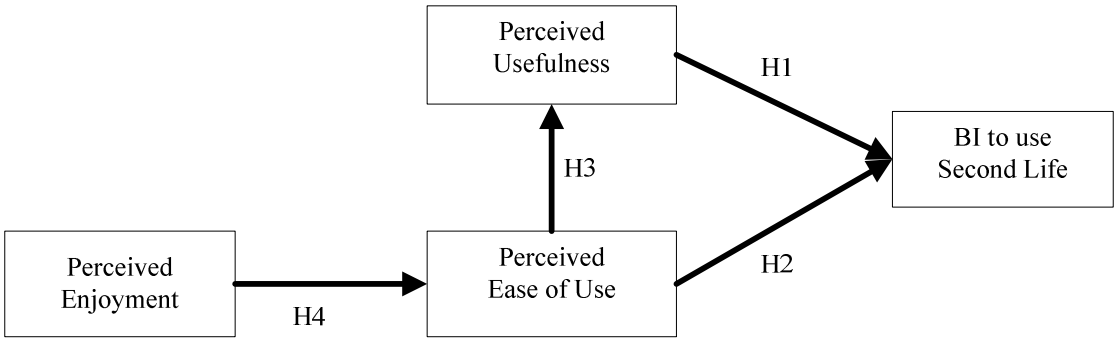

Figure 1. Research Model

According to TAM, the hypothesized relationship among PEOU, PU, and intended use are specified in H1-H3:

- H1. PU will positively affect BI to use Second Life for business.
- H2. PEOU will positively affect BI to use Second Life for business.
- H3. PEOU will positively affect PU of Second Life.

Based on previous studies of PE and TAM, the hypothesized relationship between PE and PEOU is:

- H4. PE will positively affect PEOU of Second Life.

DATA COLLECTION

Data were collected through a survey in Fall 2007. The PEOU, PU, and BI items were adapted from Davis et al. (1989). The PE items were adapted from Venkatesh (2000). All items were measured on a seven-point scale ranging from strongly disagree (1) to strongly agree (7). The questionnaire also collected user information such as demographics, familiarity with computers and the Internet, current use of social networking sites, and previous knowledge of Second Life.

The survey was given to undergraduate and continuing studies students in the business school at a university in Northeast US. The students were from two junior-level E-commerce classes and two senior-level Management Information Systems classes, and ranged in age from approximately 20-35 years old. Prior to the survey, students were given a brief introduction to SL, and an assignment involving hands-on interaction with SL. The activities include downloading and installing the Second Life client software, creating an account, and completing Linden lab's orientation island. After these basic activities, students were asked to work in teams, visit two corporate islands in Second Life (IBM and Dell), and complete tasks such as finding product information at the corporate information center, and configuring computers to specific requirements. Students were instructed to take snapshots of team members working together in Second Life, and write up a report reflecting on their experiences. Students were given three weeks from the introduction to SL to submitting the assignment.

After completing the assignment, students were given the URL to participate in the online survey. The questionnaire instructed students to think about SL being used at their work place in the future for a variety of activities, and provided examples such as conducting business meetings, collaboration with colleagues all over the world, advertising products, and recruiting and hiring. The survey was open online for one week. Extra credit was given as an incentive for survey participation.

DATA ANALYSIS AND RESULTS

The data were analyzed using SPSS and AMOS. The sections below provide the results of respondents' demographics, factor analysis, and hypotheses testing.

Demographic Statistics

Among a total of 90 students, 77 valid responses were collected, resulting in the response rate of 85.6%. Among the respondents, 68.8% were male (n=53) and 31.2% were female (n=24). The majority of the respondents were between 20-24 years old (n=66, 85.7%). The respondents reported very experienced in using a PC (Mean=6.06, SD=1.017), and very experienced in using the Internet (Mean=6.60, SD=1.09).

When asked about whether they have an account and use a social networking site regularly, the top two sites reported are Facebook and Myspace. Table 1 lists respondents' current use of social networking sites.

Web 2.0 Sites	Frequency	Percent
Facebook	57	74%
MySpace	33	42.9%
LinkedIn	13	16.9%
Other sites	10	13%

Table 1 - Use of Web 2.0 Sites

Respondents were also asked about their use of Second Life before the study. The great majority had never heard about SL before (68.8%). Some had heard about SL but do not have an account (18.2%). Only a small number of students had a SL account or used them regularly. See Table 2 for the use of Second Life before the study.

Second Life Use Before Class	Frequency	Percent
I had a SL account and logon regularly	3	3.9%
I had a SL account but rarely logon	7	9.1%
I had heard about SL but do not have an account	14	18.2%
I had never heard about SL before	53	68.8%
Total	**77**	**100.0%**

Table 2 - Use of Second Life Before the Study

Factor Analysis

Confirmatory factor analysis was conducted and the results yielded three factors as shown in the research model: PEOU (6 items), PU (6 items), PE (3 items). BI was measured using one item in the survey, which formed a one-item factor. The reliability of the factors was tested using Cronbach's α, and all three factors had high reliability scores well above the required .70 level. The result confirmed the factors found in previous TAM and extended TAM studies. Table 3 shows the number of items and the reliabilities scores of the factors.

Factors	No. of Items	Reliability
Perceived Ease of Use	6	0.91
Perceived Usefulness	6	0.98
Perceived Enjoyment	3	0.9
BI	1	/

Table 3 - Factor Reliability

Table 4 provides the means and standard deviations of the four factors. As shown, the mean scores of all four factors fall below neutral. The standard deviations are relatively high, meaning there were a wide range of perceptions among students. This suggest that while some respondents highly enjoyed their interactions with SL, and had high perceptions of the system

in terms of ease of use, usefulness, and intentions to use; others did not enjoy the experience at all and reported negative perceptions towards the system.

Factors	Mean	S.D.
Perceived Ease of Use	3.73	1.43
Perceived Usefulness	3.33	1.69
Perceived Enjoyment	3.90	1.64
BI	3.77	1.84

Table 4 - Factors Descriptive Statistics

Table 5 lists the correlations among the constructs.

	PEOU	PU	PE	BI
Perceived Ease of Use	1.00			
Perceived Usefulness	0.51	1.00		
Perceived Enjoyment	0.79	0.54	1.00	
BI	0.44	0.87	0.47	1.00

Table 5 – Correlation of Constructs

Testing of the Model and Hypotheses

The Structural Equation Modeling (SEM) was applied to test the fitness of the model. SEM yields results of path coefficients, which indicates the positive and negative relationships between the constructs, the strength of the relationships, and their statistical significance. The test also yields squared multiple correlations (R^2) values, which indicate the amount of variance of the dependent construct that can be explained by the independent constructs. In terms of the overall fit of the model, the results show χ^2 to degree of freedom ratio of 1: 2.10 (χ^2_{103}= 216.774), RMR = 0.447, GFI= 0.765, and AGFI = 0.69, suggesting an overall good fit of the model.

Figure 2 shows the results of the SEM test. All of the paths are significant at p<.005 level. Overall the model accounts for 84% of variance for BI, 79% for PEOU, and 34% for PU. PEOU has a higher path coefficient to BI (.60) than PU to BI (.42). PEOU also has a high path coefficient to PU (.58). Additionally, PE is a strong antecedent to PEOU with a path coefficient of .89.

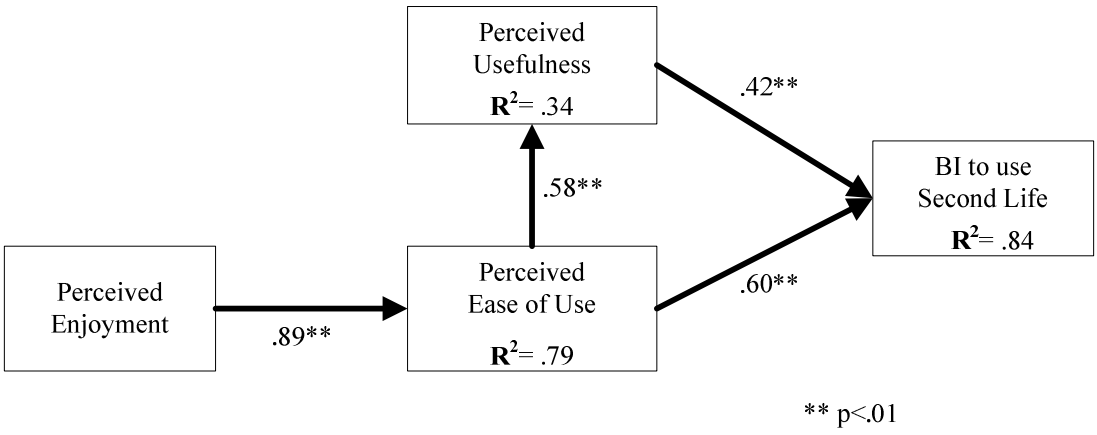

Figure 2 - Research Model with Results

Thus the hypotheses testing results are:

- H1. PU will positively affect BI to use Second Life for business. *Supported*
- H2. PEOU will positively affect BI to use Second Life for business. *Supported*
- H3. PEOU will positively affect PU of Second Life. *Supported*
- H4. PE will positively affect PEOU of Second Life. *Supported*

DISCUSSION

This study examined factors associated with one's intention to use Second Life for business. With survey data from 77 respondents, three factors were identified as significant antecedents to user's intention to adopt SL: PE, PEOU, and PU. The model explained 84% of variance in BI. Using structure equation modeling, the results supported all four hypotheses.

One key result from the study is that PEOU is a stronger determinant of BI than PU. Previous TAM studies show that the impact of PU and PEOU on BI changes as users gain more experiences with the system (Adams, Nelson et al., 1992; Karahanna, Straub et al., 1999). The effect of PEOU on BI is more significant before the use of the technology, and PU gains more impact on BI after users have experiences with the system. Venkatesh et al. (2000) conducted a longitudinal study using three organizations and took three measures over a three-month period. Their results show that PEOU decreased its impact on BI over time, while the impact of PU increased. In this study, respondents were given a relatively short period of time to learn and use SL, and the tasks did not require in-depth interaction with SL. Therefore it is perhaps not surprising to see that at the early stage, how easy it is to use SL has a greater impact on user's intention to use SL than how useful SL is.

Another possible explanation to the stronger impact of PEOU than PU could be that respondents considered SL more as a system that they can use for enjoyment than work. Previous TAM studies have shown that the effect of PEOU on BI could be affected by the nature of systems, especially hedonic vs. utilitarian systems (van der Heijden, 2004). . Hedonic systems aim at providing self-fulfilling value to the user, whereas utilitarian systems assist users in completing their jobs. Im, Kim, and Han (2008) reported that when the technology is hedonic (such as MSN Instant Messenger), the effect of PEOU on BI will be strengthened. Other studies found strong effects of PU on BI when the technology is job-related (Lai and Li, 2005). With the similarities between virtual worlds such as Second Life, and popular MMO (Massively Multiplayer Online) games such as the World of Warcraft, both of which supporting computer-generated 3-D avatars interacting online, it is reasonable to postulate that many respondents regarded SL as a technology for entertainment, but not job-related.

The same reasoning could also explain the strong impact of PE on PEOU, and the high amount of variance of PEOU that can be explained by PE. When SL is considered more as a technology for fun, perceived enjoyment becomes very important and has a high impact on how easy people perceived the system can be used. This might support the notion that virtual worlds appeal most to the 18-34 year old population, since they are also the primary users of MMOs.

LIMITATIONS AND AREAS FOR FURTHER RESEARCH

One limitation of the study was the network speed and restriction of the campus network through which many students tried to connect to SL. The graphic-intensive nature of SL requires high-speed Internet access in order to have a reasonable experience interacting with the system. While many students tried to use the wireless campus network to access SL, the connections were weak and slow in the classrooms used by the classes. Some students also had problems creating accounts on SL due to the firewall restrictions on campus servers. These network difficulties may have discouraged students, and could have contributed to their overall negative perceptions of SL. The sample size (n=77), while sufficient for the exploratory nature of this project, may have limited the generalizability of the findings.

There are many areas for additional research in this area. First, additional studies can be conducted to examine the impacts of these same factors over time. Will people become more likely to use SL once they are more familiar with the system? Will the impact of PEOU and PU on BI change over time, and if so, why? A longitudinal study with measures at different times will be helpful to answer these questions. Another area worth further study is the examination other relevant user-related variables, such as computer anxiety, computer playfulness, etc., to provide a better understanding of the factors that affect one's intention to use virtual worlds such as Second Life.

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